

Endocrine organs

Endocrine organs (endocrine glands) produce hormones, which they release into the body's circulation. Hormones are not released into the environment outside of the body. Endocrine organs include the following:

- **glandula thyroidea** – thyroid gland;
- **glandulae parathyroideae** – parathyroid glands;
- **pars endocrina pancreatis** – the endocrine pancreas (islets of Langerhans);
- **glandula pinealis** – epiphysis;
- **glandulae suprarenales** – adrenal glands;
- **glandula pituitaria** – hypophysis;
- **hypothalamo hypophyseal axis**.

Other endocrinologically active parts of the body include diffuse endocrine system.

Endocrine organs (brief overview)

Thyroid gland

Thyroid gland contains spherical follicles, in which both iodine-containing hormones are produced: thyroxine (T4), triiodothyronine (T3). Their synthesis and release is controlled by the hypothalamus (TRH) and hence the adenohypophysis (TSH). Their formation is directly dependent on the supply of iodine. In addition, the thyroid gland contains parafollicular cells (C-cells) in which calcitonin (CT) is synthesized.

Thyroid hormones:

1. thyroxine and triiodothyronine (T3 and T4),
2. calcitonin (CT).

Effect of T3 and T4 :

- morphogenetic (differentiation) factor in development- especially brain development,
- metabolic: increase metabolism and oxygen consumption,
- positive chronotropic (increase in frequency) and positive inotropic (increase in contraction force) effect in the heart,
- increase in hematopoiesis,
- potentiate the action of other hormones (eg cortisol) in the cell,
- increase the reflex response.

CT effect

- lowers the level of calcium in the blood

Parathyroid glands

These are 4 small glands located at the upper and lower poles of both lobes of the thyroid gland. They contain 2 types of cells: major and oxyphilic. The major cells secrete parathyroid hormone (PTH) and the function of oxyphilic cells is not yet known.

Parathyroid hormone

1. Parathormone (PTH)

Effect of PTH

- calcium release from bones,
- renal excretion of calcium and phosphate
- absorption of calcium and phosphates in the intestine.

Islets of Langerhans of the pancreas

The islets of the pancreas are the endocrine gland that is scattered inside the pancreas. They are made up of four types of cells. A (alpha) cells produce glucagon, B cells (beta) insulin, D cells (delta) somatostatin and F cells pancreatic polypeptide (PP), the function of which is unknown.

Hormones of the islets of Langerhans

1. glucagon,
2. insulin,
3. somatostatin,
4. pancreatic polypeptide.

Effects of islets of Langerhans

Glucagon

1. glycogenolytic (causes the breakdown of glycogen in the liver and the subsequent release of glucose),
2. gluconeogenic (causes the production of glucose from amino acids),
3. lipolytic (releases fatty acids from adipose tissue),
4. ketogenic (increases the production of ketone bodies in the liver utilizing fatty acids).

Insulin - lowers glycemia - facilitates the entry of glucose into cells, increases the entry of Na^+ and K^+ into cells, stimulates protein synthesis and inhibits protein breakdown, enhances the production of glycogen in the liver, stimulates fat production.

Somatostatin - inhibits insulin and glucagon secretion by a paracrine mechanism.

Adrenal glands

The adrenal glands are a pair of endocrine glands located at the upper poles of the kidneys. The human adrenal glands weigh about 8-10 g and are composed of yellow (the color is given by the presence of lipids) cortex (90% of the volume of the adrenal glands) and red (due to strong blood supply) medulla (10%).

Adrenal cortex

The adrenal cortex consists of 3 layers:

- zona glomerulosa - aldosterone secretion,
- zona fasciculata - cortisol formation,
- zona reticularis - production of androgens and cortisol .

Effects of aldosterone

- affects mineral metabolism (mineralocorticoid) - maintains normal levels of Na^+ and K^+ in the blood and maintains ECF volume.

Effects of cortisol

- glucocorticoid - acts on glucose metabolism,
- effect on intermediate metabolism,
- proteocatabolic effect,
- anti-inflammatory effects.

Effects of cortical androgens

- dehydroepiandrosterone and androstenediol, originally with weak activity, are converted in peripheral tissues to highly potent testosterone and dihydrotestosterone,
- proteoanabolic effect.

Adrenal medulla

The medulla is a specialized part of the sympathoadrenal system. Activation of the medulla causes such changes that lead to the survival of the organism under extraordinary conditions.

Adrenal medulla hormones (catecholamines)

1. dopamine ,
2. norepinephrine,
3. epinephrine.

Effects of catecholamines

- cardiovascular - increase myocardial irritation and heart rate,
- effects on smooth muscles outside the vessel - vasoconstriction, increase in blood pressure,
- metabolic effects - increasing metabolism and heat production, glycogenolysis in the liver, lipolysis in adipose tissue.

Hypothalamus

By hypothalamus we mean a part of the brain (diencephalon) containing a number of small nuclei with many functions. One of the main functions is the connection of the nervous and endocrine systems through the pituitary gland.

Hypothalamic hormones

- hypothalamic regulatory hormones (RH and IH - releasing and inhibiting) - affect the secretion of adenyohypophyseal tropins,
- oxytocin,
- ADH .

Hypothalamic-pituitary system: Hypothalamic regulatory hormones are transported through the portal system to the adenohypophysis, where they affect its further activity. Oxytocin and ADH are transported via axons to the neurohypophysis. Only here are they released into the blood and travel further into the body. Effects of hypothalamic hormones In particular, influencing the function of the adenohypophysis and the transport of oxytocin and ADH to the neurohypophysis.

Pituitary gland

The pituitary gland consists of two functionally and morphologically different parts: the anterior lobe - the adenohypophysis and the posterior lobe - the neurohypophysis. The adenohypophysis originates from Rathke's oropharyngeal outgrowth and is of ectoderm origin. The neurohypophysis is made up of axons of secretory neurons and glial cells (pituicity). The adenohypophysis produces a large amount of hormones, its activity is affected by RH and RI hormones from the hypothalamus, the neurohypophysis does not produce hormones, it only transmits hormones from the hypothalamus (oxytocin and ADH) to the blood.

Anterior pituitary hormones

1. Somatotropin (STH),
2. Prolactin (PRL),
3. ACTH,
4. thyrotropic hormone - thyrotropin,
5. luteinizing hormone - lutropin,
6. follicle stimulating hormone - follitropin.

Effects of adenohypophyseal hormones

- **STH** - growth stimulation, protein synthesis, positive nitrogen and phosphorus balance, retention of Na⁺ and K⁺ independent of aldosterone.
- **PRL** - stimulation of lactation after childbirth.
- **ACTH** - regulation of corticoids.
- **Tropins** - control other endocrine organs.

Posterior pituitary hormones

They are synthesized in the hypothalamus, transported to the neurohypophysis and from there released into the blood:

1. oxytocin,
2. antidiuretic hormone (ADH).

Effects of neurohypophyseal hormones

- **Oxytocin** - induces uterine contractions during childbirth and milk duct contraction during breastfeeding.
- **ADH** - increases the resorption of Na⁺ and water in the distal tubule and collecting duct of the kidneys.

Testes

Two types of cells are mainly involved in the endocrine function of the testes: Leydig's and Sertoli's. Leydig cells represent 20% of the testes cell population. They produce several types of sex hormones (androgens). The most important sex hormone in men is testosterone . LH from the adenohypophysis stimulates the maturation of interstitial cells in the Leydig. Mechanism of action: testosterone binds after entry (passive diffusion) to androgen receptors in many tissue cells. The hormone-receptor complex enters the nucleus, after binding to a specific DNA sequence it induces the formation of new mRNA and thus the formation of specific proteins (muscle tissue, testes, pituitary gland). Sertoli cells are stimulated by FSH and produce hormones such as estradiol and activin / inhibin, which affect FSH production.

Testes hormones

1. testosterone - Leydig cells,

2. anti Mullerian hormone - Sertoli cells,
3. estradiol - Sertoli cells,
4. activin - Sertoli cells,
5. inhibin - Sertoli cells.

Biological effects of testosterone

- ensures the development of the male genital type in the fetus,
- induces the growth of external genitalia after puberty,
- acts on the development of secondary sexual characteristics,
- affects the skin,
- affects metabolism,
- affects the bones,
- stimulation of erythropoietin production ,
- affects the production of gonadoliberin and gonadotropins .

Ovaries

In the ovaries, under the influence of gonadotropins (FSH and LH), sex hormones are produced : estrogens , gestagens and androgens . Follicular cells produce estrogens, progesterone (progestogens) are produced by corpus luteum cells . Both structures form small amounts of androgens.

Ovarian hormones

- **estrogens** - estradiol, estron, estriol,
- **gestagens** - progesterone,
- **androgens**.

Biological activity of estrogens

- trophic, growth and differentiation effect on specific target cells,
- induce proliferation of vaginal squamous epithelium,
- stimulate the secretion of thin mucus by the glands of the cervix,
- induce the proliferative phase of the menstrual cycle,
- increase the number of progesterone receptors,
- affect the secretion of gonadotropins,
- increase the activity of osteoblasts in girls at the beginning of puberty, facilitate the closing of growth crevices more than testosterone,
- increase the resorption of Na + and water in the kidneys,
- sedative effect on erythropoietin,
- lower plasma cholesterol levels,
- manages the development of sexual behavior and its changes during the cycle,
- protective effects (brain, heart, bones) and antioxidant effects

Biological activity of progesterone

- gestagenic - preparation and maintenance of pregnancy,
- reduces the contractility of the pregnant uterus,
- reduces the production of mucus by the cervical glands and increases its viscosity,
- affect the secretion of gonadotropins,
- stimulate the development of lobules and alveoli of the mammary gland,
- increases the basal temperature.

Biological activity of androgens

- controls the growth of axillary and pubic hair,
- maintain libido,
- estrogen precursors.

Links

Related articles

- Hormones
- Hypothalamo hypophyseal axis
- Diffuse endocrine system

Used literature

- translated from wikiskripta.eu <https://www.wikiskripta.eu/index.php?curid=32563>